

Translation of the relevant portions of Reference D4

(Japanese Utility Model Application Laid-Open

JP-U-A-SHOWA-59-37534 (1984)

(Application Number: SHOWA-57-133405 (1982)))

Reference D4 discloses a device relating to a temperature sensor in a needle shape, and more particularly to a sensor which is capable of measuring a temperature of a targeted biological site at a time of a treatment, a diagnosis, etc. of a biological tissue.

Figures 1 and 2 shown an embodiment in which the present device is applied to a hyperthermia treatment of a cancer with a medical laser beam. The device in said embodiment includes a double cylinder consisting of an elongated inner tube 2 in a needle shape and an elongated outer tube 3 each in a needle shape, which are arranged coaxially by sandwiching an electrical insulating layer 1 therebetween. These inner and outer tubes 2, 3 are formed with two types of metals constituting a thermocouple. A thermocouple measuring contact point 4 in a flat ring shape having an opening at a center thereof is formed at one end units of said inner and outer tubes 2, 3 by bonding said one end units with a technique of a seam welding, etc. The terminals 5, 6 for extracting a voltage corresponding to a generating electromotive force are formed at the other end units of these inner and outer tubes 2, 3. The leads 7, 8 connected with a feedback control device (not shown) which includes a reference contact point and a potentiometer, etc. are attached to the terminals 5, 6. In order to be suitable for inserting said sensor into the biological body, the protection layer 9 consisting of a biomaterial having a lubricity and a repellency such as a polytetrafluoroethylene-silicon, a teflon, etc., is provided at an outer wall of the outer tube 3. The optical fiber 10 for guiding a medical laser beam from a laser source (not shown), and the transmitting and receiving optical fiber 11 constituting an endoscope for observing a targeted biological site for a treatment are inserted into the inner tube 2.

Since the device, which is constituted as such, is enable to feedback control an irradiance of a laser beam, while measuring a temperature of a targeted biological site at the same time with a treatment, and monitoring a situation of said biological site, the device is enable to carry out a high accurate treatment, and thus it makes possible to perform a safe and secure laser treatment without causing unnecessarily damage to a tissue or performing an insufficient treatment. Since the structure itself of the needle, which pierces

the optical fiber as the laser guide into the biological body, constitutes the sensor, a miniature-sized sensor without any waste on the constitution may be obtained. Further, although an overall size thereof is a miniature since the bonding parts of the inner and outer tubes 2, 3 constitute a sensor unit in a flat ring shape, a contact area with an object is large, and thus a temperature measurement with a high reliability may be performed.